follow the English authorities, as they follow their great master, Hume. But in giving final expression to the relation between the two series of "events," psychical and physical, shown by the analysis to be involved in the varied phenomena of intelligence, he is more strictly original; or, at least, his view is stated with peculiar neatness and force. How shall sensation, whether in the crude form or in the intellectual condition of the image or in the elemental state, be conceived as joined to something so disparate as a molecular movement in nerve: that is the difficulty. To say that what we have united is rather an idea of sensation had by (or, in the case of the ultimate psychical element, conforming to the type had by) direct personal consciousness, and an idea of nerve got indirectly by way of external sense, though this is philosophically true, touches the difficulty without removing it; for the two ideas are still irreducible to each other. But it may then more readily be suspected that the "events" are not two, but one, with two permanently distinct faces to cognition; and this, in M. Taine's view, is the final outcome of the analytic, though as regards the duality he hints at a possible reduction in his second part. Meanwhile, taking the physical aspect as secondary and the sign of a properly mental event, he seeks to illustrate the view and to enforce his theory of universal correspondence by a remarkable analogy. He supposes an original text with an interlinear translation; the translation plain and legible at the outset, but becoming confused farther on, and before the end no longer to be made out; on the other hand, the text very clear at the last but fainter higher up, and about the beginning not to be traced at all. The writing may represent nature; clear text and undecipherable translation mark the states of full intellectual consciousness so vaguely referred, at least in detail, to the complex of the brain; faint text and translation not too plain mark the cruder mental events referred to less but still highly complicated centres; finally, visible translation and blank instead of text mark the well-ascertained physiological phenomenon of reflex action, for which it is as legitimate, if not necessary, to suppose a psychical obverse, albeit unconscious, as it is to assume for highest consciousness a physical correspondence in brain-processes eluding our finest observation.

The analogy is instructively worked out further by M. Taine; but enough for the present. Another time we may better estimate the value of parts of his analysis, when considering how, from the materials it affords, he is able to build up the edifice of human knowledge.

G. CROOM ROBERTSON

A STORM-ATLAS FOR NORWAY

Storm Atlas of the Meteorological Institute of Norway. (H. Mohn.)

A KNOWLEDGE of the laws which regulate the progress of storms would be of comparatively little practical interest without the telegraph, but, since the speed of electricity outstrips that of wind, the information by telegraph that a storm has appeared at an outpost may be of great importance to a maritime country like our own, provided we know the path which the storm is likely to pursue.

Of late years practical meteorologists have devoted a great deal of attention to this branch of their subject, and the memoir before us is not the least interesting of the various contributions which have been made. It is unnecessary to enter into the details of M. Mohn's observational system; let us rather invite attention to the general conclusions at which he arrives.

"Barometric maxima," he tells us, "often remain during a considerable period over the places where they have been formed, while, on the other hand, barometric minima are almost always in motion over the surface of the earth, transporting themselves (in Europe) almost always towards the east." He further finds that the barometric minima represented in his charts have their greatest velocity of motion before they arrive at the west coast of Europe, and a smaller velocity when they pass by Scandinavia; in Russia the velocity is again greater.

As regards the component of the movement which leads the centres towards the east, he finds a greater regularity exhibited, inasmuch as this component diminishes continuously as the minima move from the sea towards the interior of the continent. The curved paths of these minima are at north Europe sometimes very regular and sometimes very sinuous; in general they are concave towards the south. The mean movement in the direction of the meridian is towards the north in the Atlantic; towards the south, but feebly, in Scandinavia; and more strongly towards the south in Russia; in this latter country they appear to lose themselves.

Let us now invite attention to the following remarks of the author with regard to vapour:—"Vapour tension is an element of which the importance for the theory of tempests was not so evident to me until I had commenced the construction of these charts. . . . . . Charts giving the relative humidity are without any value, nor do they present any trace of that continuity which shows itself so strikingly in the charts of vapour tension." Further on he says:—"I have frequently remarked in this memoir that watery vapour is one of the most important elements in studying the movement of air; it is therefore much to be desired that the publication of meteorological observations should embrace vapour tensions (which is not always the case), and if only one element can be given, let it be rather that than the relative humidity. . . . . Charts representing the distribution of the vapour of water over the surface of the earth analogous to the temperature charts of M. Dove or the isobaric charts of Mr. Buchan would be of the greatest possible utility."

It may not be out of place to make a few remarks upon these observations of M. Mohn. Meteorologists have been in the habit of discussing in two ways the state of the air with regard to vapour. They have in the first place studied the vapour tension present in the atmosphere, and secondly, they have studied the relative humidity, or what M. Mohn calls "*l'état hygrométrique*." This latter element, representing the proportion between the vapour actually contained in the air and the full amount due to the present temperature, is an element that varies very greatly with the temperature, and is, therefore, of comparatively little use in meteorological researches.

Besides these two elements, the author of this review has suggested the *hygrometric quality* of the air as a

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subject of importance in meteorological discussions. This is a very different thing from what is termed by Mohn "*l'état hygrometrique*," and denotes the chemical composition of the air, as regards moisture, or the weight of vapour contained in a hundred parts by weight of air. Now, as long as the pressure remains the same, this hygrometric quality will be represented by the tension of vapour, and, since on the surface of the earth the variations of pressure are comparatively small, the vapour tension will approximately represent the hygrometric quality. If this be borne in mind, the physical significance of Mohn's conclusions will become apparent; his remark, that the charts of vapour tension present a continuity and simplicity of distribution of that element, will now mean that the distribution of *types* or *kinds* of air is of a very simple nature.

We should, in fact, endeavour to find the distribution of air of various qualities over the surface of the earth just as we should endeavour to trace on the surface of the ocean sections of different saltness. But, while on the earth's surface vapour tension will approximately represent hygrometric quality, the case will be altered if we study strata of different elevations, and therefore of different pressures. If for instance, we ascend a mountain or take a trip in a balloon, the tension of vapour will no longer approximately represent the hygrometric quality of the air; but it will be the ratio between the pressure of aqueous vapour and that of air, which will truly represent the hygrometric quality in those regions. These considerations may, perhaps, throw some light upon the formation of clouds. If, for instance, air of the same quality extends a great way up, we shall have no cloud formed in the stratum as long as the rate of decrement of temperature does not exceed a certain limit; but when this limit is exceeded, there will be a deposition of cloud through the lowering of temperature alone, even while there is no admixture with air of another quality.

B. STEWART

OUR BOOK SHELF

Ueber Entwickelung und Bau des Gehörlabyrinths, nach Untersuchungen an Saügethieren. Von Dr. Arthur Boettcher, o. ö. Professor der allgemeinen Pathologie und pathologischen Anatomie, a. d. Universität Dorpat. Erster Theil mit zwölf Kupfer Tafeln. (Leipzig: Wilhelm Engelmann, 1871. London: Williams and Norgate.)

THE successful investigation of the structure of the internal ear must always be regarded as the crown and glory of histological research, for whilst the structures that compose the auditory organ are of extreme delicacy, they are enclosed in a bony capsule of such density as to appear to bid defiance to all attempts to exhibit them in their natural state. Yet by careful decalcification with dilute acids and by immersion in various fluids, as those of Müller Schultze's solution of chloride of palladium, Cohnheim and Gerlach's solution of chloride of gold, &c., the most delicate details have been followed out, and the structure of the ear is now almost as well known as that of the eye.

M. Boettcher's observations on the labyrinth of adult animals have been largely supplemented by his numerous examinations of the same part at various periods of fœtal life, which have led to some interesting results.

The very earliest rudiment of the labyrinth in the mammalian fœtus is not yet accurately ascertained, but in the embryo of a sheep, of which a sagittal section of the head is only a millimetre in length, it appears as a sac with a small external opening formed by an inflection of the horny layer in close contact with this and opposite the second visceral arch. The wall of the sac is formed by cylindrical cells. In a somewhat more advanced stage the vesicle becomes elongated into a tube, the upper extremity of which is divided by a fold into an internal and smaller cavity—the recessus labyrinthi, and a larger, broader cavity, the aquæductus vestibuli. The inferior extremity is pointed, and is in immediate relation with the rudiment of the cochlea.

The semi-circular canals are formed by an inflection of the wall of the labyrinth vesicle opposite to the recessus labyrinthi, the horizontal canal being the last formed. In embryoes of 2·2 cm. long, the several parts above mentioned are more fully formed, and a projection appears, the fundus of which is directed towards the brain, which is the rudiment of the sacculus rotundus, from which the utriculus or sacculus ellipticus soon becomes differentiated. The separation of a scala vestibuli from a scala tympani in the cochlea is only apparent in embryoes that have attained a length of 8·5 cm. M. Boettcher clearly shows that the recessus labyrinthi found at a very early period subsequently becomes the aquæductus vestibuli, which remains permanently in connection with the sacculus rotundus and utriculus, and contains the same fluid (endolymph) as they do. The aquæductus cochleæ, on the other hand, is a totally different formation, and is in no way connected with the interior of the labyrinth. It conducts a vein, and might more correctly be styled, as Wildberg has suggested, the canalis venosus cochleæ.

In regard to the cochlea, he shows how the canalis cochlea, or scala media, is first developed, and how the two principal scalæ (scala tympani and vestibuli) are formed by the gradual breaking down of spongy cellular tissue on either side of the scala media, and he traces out in the most interesting manner the development, chiefly from epithelium, of the complicated organ of Corti, including under this head the so-called habenula perforata, the rods, and arched fibres, &c.

He describes a remarkable ganglionic mass, the ganglion spirale, the section of which is seen in this section of the cochlea close to the attached border of the lamina spiralis. In this the cochlear nerve appears to terminate, whilst from it fresh fibres take origin, and then, having passed through the openings of the habenula perforata, join certain cells, some of which are placed outside and some inside the arcuate fibres or rows of Corti. The former kind of auditory cells are, some of them, seated with a broad base on the membrana basilaris, whilst the attenuated extremity of the cell runs upwards. Others, however, are intercalated with these, which have a broad base attached to the membrana reticularis above, and then narrow apices interposed between the broad bases of the former. The cells that point downwards are Corti's cells, and are arranged in three rows. They possess a centrically directed process. The cells that point upwards are the so-called hair-cells, which receive this name on account of their terminating at both ends in a hair. The membrana basilaris he describes as consisting of a hyaline lamella on which is a fibrous layer, both layers having a peculiar form of epithelial investment. Beneath its proximal attachment is a spiral vessel. The development of all these parts is carefully traced. A very full account is given of Corti's membrane. He denies the existence of muscular elements in Todd and Bowman's ligamentum spirale. The essay concludes with a description of the ultimate distribution of the auditory nerve. The drawings, which are upwards of sixty in number, and in some instances of large size, are very beautifully executed. On the whole, the work of Boettcher appears to be well worthy the attention of microscopists and physiologists, and to contain many facts possessing both novelty and interest.

H. P.

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